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Professor Nadia Badawi

Macquarie Group Foundation Chair of Cerebral Palsy
PO Box 560, Darlinghurst, New South Wales 2010 Australia

Interventions and Management

1. Pediatrics. 2012 Oct 8. [Epub ahead of print]

Clinical Prognostic Messages From a Systematic Review on Cerebral Palsy.

Novak I, Hines M, Goldsmith S, Barclay R.

Cerebral Palsy Alliance Research Institute, Sydney, Australia; and.

OBJECTIVE: To summarize evidence on the rates of co-occurring impairments, diseases, and functional limitations with cerebral palsy into succinct clinical messages. **METHODS:** A search was conducted of the databases PubMed, Medline, CINAHL, and PsycINFO, and the results were supplemented with hand searches. Two independent reviewers determined whether retrieved abstracts met the following inclusion criteria: human subjects; >90% were children or adults with cerebral palsy; published after 1999; and population-based data. Articles were appraised, analyzing design, participants, level of evidence, rates of impairments, and functional implications. Methodologic quality was rated by using a standardized checklist. **RESULTS:** A total of 1366 papers were identified in the search; 82 were appraised and 30 were included in the meta-analyses. High-level evidence existed, as rated on the Oxford 2011 Levels of Evidence: 97% of prevalence studies were level 1. The data were of a moderate to high quality grade (with the exception of sleep disorders), allowing plain English clinical messages to be developed. **CONCLUSIONS:** Among children with cerebral palsy, 3 in 4 were in pain; 1 in 2 had an intellectual disability; 1 in 3 could not walk; 1 in 3 had a hip displacement; 1 in 4 could not talk; 1 in 4 had epilepsy; 1 in 4 had a behavior disorder; 1 in 4 had bladder control problems; 1 in 5 had a sleep disorder; 1 in 5 dribbled; 1 in 10 were blind; 1 in 15 were tube-fed; and 1 in 25 were deaf.

[PMID: 23045562](https://pubmed.ncbi.nlm.nih.gov/23045562/) [PubMed - as supplied by publisher]

2. Gait Posture. 2012 Oct 3. pii: S0966-6362(12)00327-X. doi: 10.1016/j.gaitpost.2012.08.022. [Epub ahead of print]

Spatial rotational orientation ability in standing children with cerebral palsy.

Petrarca M, Cappa P, Zanelli G, Armando M, Castelli E, Berthoz A.

Movement Analysis and Robotic Laboratory (MARLab) - Pediatric Neuro-Rehabilitation Division, "Bambino Gesù" Children's Hospital, IRCCS, Rome, Italy. Electronic address: maurizio.petrarca@opbg.net.

This study quantified perception and reorientation ability after passive horizontal rotations in thirteen children with cerebral palsy (CP). They stood barefoot on a platform in front of a fixed reference point (static posture task, SPT) and were then blindfolded and passively rotated with six velocity profiles (maximum angular velocity: 57°/s; rotation amplitudes: ±90°, ±180° and ±360°). After the perturbation, the blindfolded children were asked to point to the fixed reference point with their preferred hand (pointing task, PT) and to step back to the initial position on the stationary platform (reorientation task, RT). In order to gain further insight into rotational attitude, the results were comparatively examined with body segment rotations determined using standardized gait analysis (gait task, GT). The kinematic evaluations were conducted using an optoelectronic system: for SPT, PT and RT we confined the analysis, in the horizontal plane, to the head and upper pointing arm of the subject and to the platform; for GT a full body analysis was performed. When CP children were passively rotated towards their more affected side, they overestimated the imposed angle in PT but under-reproduced it in RT. A higher variability emerged in left-hemiplegic children, confirming that the spatial disorganization is predominantly related to right brain lesion. Patients tended to rotate in GT towards the more affected side while in RT they showed an opposite trend.

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3. Gait Posture. 2012 Oct 4. pii: S0966-6362(12)00354-2. doi: 10.1016/j.gaitpost.2012.09.011. [Epub ahead of print]

Long term outcome of single event multilevel surgery in spastic diplegia with flexed knee gait.

Sung KH, Chung CY, Lee KM, Akhmedov B, Lee SY, Choi IH, Cho TJ, Yoo WJ, Park MS.

Department of Orthopaedic Surgery, Seoul National University Bundang Hospital, Kyungki, Republic of Korea.

Distal hamstring lengthening (DHL) is a commonly performed procedure in flexed knee gait. However, the necessity of this procedure has been challenged due to the concerns on adverse effects in long-term follow-up. This retrospective study was undertaken to investigate the long-term outcome of single event multilevel surgery (SEMLS), including bilateral DHL, in ambulatory patients with cerebral palsy using 3D gait analysis. Twenty-nine ambulatory patients with spastic diplegic cerebral palsy who had undergone SEMLS including bilateral DHL were included. 3D gait analysis was performed preoperatively, 1 year postoperatively and over 10 years postoperatively. Preoperative temporal parameters, kinematics and GDI were compared with values obtained 1 and 10 year follow-up visits. The mean age of patients at time of first surgery was 8.3 years (range, 5.4-16.3 years), and mean time from first surgery to last 3D gait analysis was 11.8 years (range, 10.0-13.3 years). Mean pelvic tilt was not changed significantly after SEMLS including DHL. Mean knee flexion at initial contact decreased from 31.1° preoperatively to 26.0° at 1 year postoperatively ($p=0.065$), and then decreased significantly to 23.6° at 10 years postoperatively ($p=0.038$) versus the preoperative value. Mean GDI score significantly improved from 69.4 preoperatively to 77.9 at 1 year postoperatively ($p=0.003$) and continuously improved to 82.2 at 10 years postoperatively ($p=0.017$). Single event multilevel surgery including DHL provides a favorable outcome 10 years postoperatively in patients with spastic diplegic cerebral palsy.

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4. J Neurosurg Pediatr. 2012 Oct 5. [Epub ahead of print]

Evaluation of salvage techniques for infected baclofen pumps in pediatric patients with cerebral palsy.

Hester SM, Fisher JF, Lee MR, Macomson S, Vender JR.

Department of Neurosurgery and.

Object: Intrathecal baclofen therapy has been used successfully for intractable spasticity in children with cerebral palsy. Infections are rare, but they are potentially life threatening if complicated by bacteremia or meningitis. Treatment without removal of the system is desirable if it can be done safely and effectively. Methods: The authors

reviewed the records of 207 patients ranging from 3 to 18 years of age with cerebral palsy who underwent placement or revision of a baclofen pump. They identified 38 patients with suspected or documented infectious complications. Initial attempts were made to eradicate infection with the devices in situ in all patients. Methods and effectiveness of pump salvage were evaluated. Results: Of the 38 patients identified, 13 (34.2%) had documented infections; 11 had deep wound/pocket empyemas and 2 had meningitis. Eight patients with deep wound infections received intravenous antibiotics alone. All required pump explantation. The remaining 3 patients underwent a washout procedure as well; the infection was cured in 1 patient. Both patients with meningitis received intravenous and intrathecal antibiotics, and both required device explantation. In addition, 25 patients (65.8%) had excessive or increasing wound erythema. No objective criteria to document a superficial infection were present. The wounds were considered suspicious and were managed with serial examinations and oral antibiotics. The erythema resolved in 24 of the 25 patients. Conclusions: In general, observation, wound care, and oral antibiotics are sufficient for wounds that are suspicious for superficial infection. For deep-seated infection, antibiotic therapy alone is generally insufficient and explantation is required. Washout procedures can be considered, but failures are common.

[PMID: 23039838](#) [PubMed - as supplied by publisher]

5. Ortop Traumatol Rehabil. 2012 Aug 31;14(4):371-83. doi: 10.5604/15093492.1011632.

Changes of kinematics parameters of pelvis during walking under the influence of means facilitates treatment of cerebral palsied children.

Czupryna K, Nowotny J.

Zakład Fizjoterapii, Wyższa Szkoła Administracji / Institute of Physiotherapy, Higher School of Administration.

Background. Physiological human gait is characterized by tree-dimensional pelvis movements, which make that gait is smooth and does not require excessive energy expenditure. In children with cerebral palsy determinants of the pelvis may be affected, mainly due to pathological afferent synergisms. Therefore many specialists is looking for ways to improve this situation. The aim of this study was to verify whether the use of botulinium toxin or inhibitive casts affects the kinematic parameters of the pelvis during the gait of children with hemiparetic form of cerebral palsy. Material and methods. The study involved 34 hemiparetic children with cerebral palsy aged 7-14 years who reached the capacity of walking. All were improving by neurodevelopmental treatment according to NDT-Bobath method. Two groups were created. In the first group inhibiting casting was used in 16 children. In the second group botulinium toxin was injected in 18 children. Gait analysis was performed before and after using those type of treatment. Ultrasonic CMS-HS system (Zebris) was used for three dimensional gait analysis. Results. Despite of the characteristic for hemiplegic gait pattern asymmetry, various abnormalities of pelvis kinematic parameters were observed. Gait symmetry was improved after the treatment. Using inhibiting casts also improved kinematic parameters of the pelvis, especially in those children who are found deficit of decreasing and rotation of the pelvis. Conclusions. 1) The use of Btx-A or inhibitive casts results in improving temporal- spatial parameters of gait of cerebral palsied children with hemiparesis. 2) The improvement of kinematic pelvis parameters are obtained through the use of inhibitive casts, while the use of Btx-A does not have a significant impact on them.

[PMID: 23043059](#) [PubMed - in process]

6. BMJ. 2012 Oct 9;345:e6675. doi: 10.1136/bmj.e6675.

Early radiographic surveillance is needed to prevent sequelae of neglected hip displacement in cerebral palsy.

Willoughby KL, Graham HK.

Orthopaedic Department, Royal Children's Hospital, Parkville, VIC 3052, Australia.

[PMID: 23047964](#) [PubMed - in process]

7. *Pediatr Neurol.* 2012 Nov;47(5):345-8. doi: 10.1016/j.pediatrneurol.2012.07.005.**Peripheral magnetic stimulation to decrease spasticity in cerebral palsy.**

Flamand VH, Beaulieu LD, Nadeau L, Schneider C.

Laboratoire de neuroStimulation et Neurosciences Cliniques, Axe Neurosciences, Centre de Recherche du Centre Hospitalier Universitaire de Québec, Québec City, Québec, Canada; Département de Réadaptation, Université Laval, Québec City, Québec, Canada; Centre Interdisciplinaire de Recherche en Réadaptation et Intégration Sociale, Institut de Réadaptation en Déficience Physique de Québec, Québec City, Québec, Canada. Electronic address: veronique.flamand.1@ulaval.ca.

Muscle spasticity in pediatric cerebral palsy limits movement and disrupts motor performance, thus its reduction is important in rehabilitation to optimize functional motor development. Our pilot study used repetitive peripheral magnetic stimulation, because this emerging technology influences spinal and cerebral synaptic transmission, and its antispastic effects were reported in adult neurologic populations. We tested whether five sessions of tibial and common peroneal nerve stimulation exerted acute and long-term effects on spasticity of the ankle plantar flexor muscles in five spastic diparetic children (mean age, 8 years and 3 months; standard deviation, 1 year and 10 months). Muscle resistance to fast stretching was measured with a manual dynamometer as a spasticity indicator. A progressive decrease was observed for the more impaired leg, reaching significance at the third session. This sustained reduction of spasticity may reflect that the peripheral stimulation improved the controls over the spinal circuitry. It thus suggests that a massive stimulation-induced recruitment of sensory afferents may be able to influence central nervous system plasticity in pediatric cerebral palsy.

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[PMID: 23044016](#) [PubMed - in process]

8. *BMJ.* 2012 Oct 9;345:e6670. doi: 10.1136/bmj.e6670.**Selective dorsal rhizotomy remains experimental in cerebral palsy.**

Crilly MA.

Polwarth Building, Aberdeen University Medical School, Aberdeen AB25 2ZD, UK.

[PMID: 23047963](#) [PubMed - in process]

9. *Neurorehabil Neural Repair.* 2012 Oct 4. [Epub ahead of print]**Muscle Plasticity and Ankle Control After Repetitive Use of a Functional Electrical Stimulation Device for Foot Drop in Cerebral Palsy.**

Damiano DL, Prosser LA, Curatalo LA, Alter KE.

National Institutes of Health, Bethesda, MD, USA.

BACKGROUND: **OBJECTIVES:** The primary goal was to determine whether repetitive functional electrical stimulation (FES) for unilateral foot drop increases tibialis anterior (TA) muscle size compared with an untreated baseline and the contralateral side in cerebral palsy (CP). Secondary goals were to determine whether positive changes in muscle size and gait, if found, accumulated during the 3 intervals during which participants used the device. FES devices differ from traditional orthoses that often restrict muscle activation and may exacerbate weakness, promote continued dependence on orthoses, or precipitate functional decline. **METHODS:** Participants were 14 independent ambulators with inadequate dorsiflexion in swing, with a mean age of 13.1 years, evaluated before and after the 3-month baseline, 1-month device accommodation, 3-month primary intervention, and 3-month follow-up phases. The FES device (WalkAide) stimulated the common fibular nerve to dorsiflex the ankle and evert the foot while monitoring use. TA muscle ultrasound, gait velocity, and ankle kinematic data for barefoot and device conditions are reported. **RESULTS:** Ultrasound measures of TA anatomic cross-sectional area and muscle

thickness increased in the intervention compared with baseline and with the contralateral side and were maintained at follow-up. Maximum ankle dorsiflexion decreased at baseline but improved or was maintained during the intervention phase with and without the device, respectively. Muscle size gains were preserved at follow-up, but barefoot ankle motion returned to baseline values. **CONCLUSIONS:** This FES device produced evidence of use-dependent muscle plasticity in CP. Permanent improvements in voluntary ankle control after repetitive stimulation were not demonstrated.

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10. Osteoporos Int. 2012 Sep 28. [Epub ahead of print]

Efficacy of home-based virtual cycling training on bone mineral density in ambulatory children with cerebral palsy.

Chen CL, Chen CY, Liaw MY, Chung CY, Wang CJ, Hong WH.

Physical Medicine and Rehabilitation, Chang Gung Memorial hospital, Linkou, 5 Fu-Hsing St. Kwei-Shan, Tao-Yuan, 333, Taiwan.

The 12-week home-based virtual cycling training (hVCT) improved lower limb muscle strength and areal bone mineral density (aBMD) than the control program in children with cerebral palsy (CP). A muscle strengthening program, rather than general physical activity, is more specific in enhancing aBMD for these children. A novel hVCT is an effective and efficient strategy that enhances lower limb bone density in these children. **INTRODUCTION:** This is the first study to assess the efficacy of a novel hVCT program on bone density for children with spastic CP using a well-designed randomized controlled trial. **METHODS:** Twenty-seven ambulatory children with spastic CP, aged 6-12 years, were randomly assigned to the hVCT group (n = 13) or control group (n = 14). Outcome measures-motor function [Gross Motor Function Measure-66 (GMFM-66)], muscle strength (curl up scores and isokinetic torque of knee extensor and flexor muscle) and aBMD of the lumbar and distal femur-were administered before and immediately after the 12-week intervention. **RESULTS:** Analysis of covariance results show that the hVCT group had greater distal femur aBMD and isokinetic torques of knee extensor and flexor muscles than the control group at posttreatment ($p < 0.05$). However, curl up scores, GMFM-66, and lumbar aBMD at posttreatment did not differ between the two groups. **CONCLUSIONS:** Analytical findings suggest that the muscle strengthening program is more specific in enhancing bone density for children with CP than general physical activity. Thus, the proposed 12-week hVCT protocol is an effective and efficient strategy for improving lower limb aBMD in these children.

[PMID: 23052930](#) [PubMed - as supplied by publisher]

11. J Rehabil Med. 2012 Oct 11. doi: 10.2340/16501977-1037. [Epub ahead of print]

Comparison of muscle strength, sprint power and aerobic capacity in adults with and without cerebral palsy.

Groot SD, Dallmeijer AJ, Bessems PJ, Lamberts ML, Woude LH, Janssen TW.

Amsterdam Rehabilitation Research Center, NL-1040 HG Amsterdam, The Netherlands.
s.d.groot@rcamsterdam.nl, s.d.groot@reade.nl.

Objective: To compare: (i) muscle strength, sprint power and maximal aerobic capacity; and (ii) the correlations between these variables in adults with and without cerebral palsy. **Design:** Cross-sectional study. **Subjects:** Twenty adults with and 24 without cerebral palsy. **Methods:** Isometric and isokinetic knee extension strength, sprint power (mean power over the 30s (P30)), peak aerobic power output (PO_{peak}) and oxygen uptake (VO_{2peak}) were determined. Regression analysis was used to investigate correlations between parameters. **Results:** Adults with cerebral palsy had significantly lower strength (53-69%) and P30 (67%) than adults without cerebral palsy, but similar PO_{peak} and VO_{2peak}. In adults without cerebral palsy the only significant correlations, albeit weak, were between P30 and isometric ($R^2 = 0.34$) or isokinetic strength ($R^2 = 0.20$), as well as the correlation between P30 and VO_{2peak} ($R^2 = 0.26$) or PO_{peak} ($R^2 = 0.36$). Stronger correlations were found in the group with cerebral palsy between P30 and isometric ($R^2 = 0.52$) and isokinetic strength ($R^2 = 0.71$) and between P30 and VO_{2peak} ($R^2 = 0.75$) or PO_{peak} ($R^2 = 0.94$). **Conclusion:** In contrast to aerobic capacity, strength and P30 are reduced in (active)

people with cerebral palsy. Stronger correlations were found between strength, P30 and POpeak in adults with cerebral palsy. Therefore, muscle strength may be the limiting factor in adults with cerebral palsy for activities involving the lower extremities, such as cycling.

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Prevention and Cure

12. J Perinatol. 2012 Oct 4. doi: 10.1038/jp.2012.121. [Epub ahead of print]

Discordance in neonatal risk factors and early childhood outcomes of very low birth weight (<1.5 kg) twins.

Steingass KJ, Taylor HG, Wilson-Costello D, Minich N, Hack M.

Department of Pediatrics, The Ohio State University, Nationwide Children's Hospital, Columbus, OH, USA

Objective: To examine the rates of discordance in neonatal risk factors and neurodevelopmental outcomes within very low birth weight twin pairs and the factors associated with discordant outcomes. **Study Design:** Rates of neonatal risk factors and neurodevelopmental outcomes, and discordance in outcomes were examined for 88 very low birth weight twin pairs born between 1990 and 2005 and followed through 20 months' corrected age. **Result:** Discordance rates ranged from 17 to 42% for neonatal risk factors and from 18 to 31% for neurodevelopmental outcomes. In regression analysis, affected co-twins were significantly more likely to have had an abnormal cerebral ultrasound than their unaffected co-twins in pairs discordant for cerebral palsy (odds ratio (OR): 13.00, 95% confidence interval (CI): 2.22 to 76.03) and in pairs discordant for neurodevelopmental impairment (OR: 4.00, 95% CI: 1.13 to 14.18). Outcomes and discordance in outcomes were similar for monochorionic and dichorionic pairs. **Conclusion:** Despite shared genetics and risk factors, twins may have discordant outcomes. Information on discordant neonatal and neurodevelopmental outcomes is important for counseling families of twins.

[PMID: 23047425](#) [PubMed - as supplied by publisher]

13. Acta Paediatr. 2012 Jul;101(7):719-26. doi: 10.1111/j.1651-2227.2012.02677.x. Epub 2012 Apr 24.

Early single-channel aEEG/EEG predicts outcome in very preterm infants.

Wikström S, Pupp IH, Rosén I, Norman E, Fellman V, Ley D, Hellström-Westas L.

Department of Women's and Children's Health, Uppsala University, Sweden. sverre.wikstrom@liv.se

AIM: To characterize early amplitude-integrated electroencephalogram (aEEG) and single-channel EEG (aEEG/EEG) in very preterm (VPT) infants for prediction of long-term outcome. **PATIENTS:** Forty-nine infants with median (range) gestational age of 25 (22-30) weeks. **METHODS:** Amplitude-integrated electroencephalogram/EEG recorded during the first 72 h and analysed over 0-12, 12-24, 24-48 and 48-72 h, for background pattern, sleep-wake cycling, seizures, interburst intervals (IBI) and interburst percentage (IB%). In total, 2614 h of single-channel EEG examined for seizures. Survivors were assessed at 2 years corrected age with a neurological examination and Bayley Scales of Infant Development-II. Poor outcome was defined as death or survival with neurodevelopmental impairment. Good outcome was defined as survival without impairment. **RESULTS:** Thirty infants had good outcome. Poor outcome (n = 19) was associated with depressed aEEG/EEG already during the first 12 h (p = 0.023), and with prolonged IBI and higher IB% at 24 h. Seizures were present in 43% of the infants and associated with intraventricular haemorrhages but not with outcome. Best predictors of poor outcome were burst-suppression pattern [76% correctly predicted; positive predictive value (PPV) 63%, negative predictive value (NPV) 91%], IBI > 6 sec (74% correctly predicted; PPV 67%, NPV 79%) and IB% > 55% at 24 h age (79% correctly predicted; PPV 72%, NPV 80%). In 35 infants with normal cerebral ultrasound during the first 3 days, outcome was correctly predicted in 82% by IB% (PPV 82%, NPV 83%). **CONCLUSION:** Long-term outcome can be predicted by aEEG/EEG with 75-80% accuracy already at 24 postnatal hours in VPT infants, also in infants with no early indication of brain injury.

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Comment in: [Is there clinical benefit from early electroencephalography monitoring in very preterm infants?](#) [Acta Paediatr. 2012]

[PMID: 22530996](#) [PubMed - indexed for MEDLINE] PMID: PMC3437495

14. Indian J Med Res. 2012 Sep;136(3):436-44.

Aetiologic spectrum of mental retardation & developmental delay in India.

Aggarwal S, Bogula VR, Mandal K, Kumar R, Phadke SR.

Department of Medical Genetics, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, India.

Background & objectives: The aetiology of mental retardation is varied and difficult to establish. Reports from India on the spectrum of underlying causative conditions are lacking. This retrospective study was conducted to establish the various aetiologies of mental retardation (MR) and developmental delay (DD) in patients attending a medical genetics centre in north India and to assess the contribution of genetic disorders. **Methods:** This retrospective study was conducted at a tertiary care centre in north India. All patients attending the centre with MR or DD from January 2007 to December 2009 were included. The aetiology of MR/DD was ascertained after clinical assessment and targeted laboratory evaluation. The spectrum of causative conditions and contribution of genetic disorders was established. **Results:** A total of 338 patients were included in the study, of whom definite diagnosis was established in 253 (74.8%). The various aetiological categories were: chromosomal disorders in 112 (33.1%), non chromosomal syndromes in 32 (9.5%), neurometabolic disorders in 34 (10.1%), central nervous system structural defects in 25 (7.4%), cerebral palsy in 43 (12.7%) and environmental insults in 7 (2%). Eighty five patients (25.2%) had idiopathic mental retardation. A total of 196 (58%) patients had a genetic disorder as the cause of MR/DD. **Interpretation & conclusions:** The aetiology of MR/DD is varied and difficult to establish in a significant proportion of patients. Chromosomal and various monogenic disorders contribute to a large number of MR/DD cases and hence a genetic work up is essential for all such patients.

[PMID: 23041737](#) [PubMed - in process]

15. Pediatr Neurol. 2012 Nov;47(5):349-54. doi: 10.1016/j.pediatrneurol.2012.08.004.

Does Antenatal Tobacco or Alcohol Exposure Influence a Child's Cerebral Palsy? A Population-Based Study.

Kyriakopoulos P, Oskoui M, Dagenais L, Shevell MI.

Division of Pediatric Neurology, Montreal Children's Hospital-McGill University Health Center, Montreal, Quebec, Canada.

Antenatal tobacco and alcohol exposure are established risk factors for premature birth and an independent risk factor for cerebral palsy. Both exert adverse effects on fetal development. In children with cerebral palsy, whether antenatal exposure to tobacco or alcohol is associated with a difference in clinical profile remains unknown. The Quebec Cerebral Palsy Registry was used to compare neurologic subtypes, gross motor functional impairment, and comorbidities in children with cerebral palsy who were or were not prenatally exposed to alcohol or tobacco. Information on in utero exposure was available in 249 children with cerebral palsy born from 1999-2002, of whom 77 were exposed to alcohol and 62 to tobacco in utero. No association was evident between exposure to tobacco or alcohol during pregnancy and neurologic subtype, Gross Motor Function Classification System score, mean number of comorbidities experienced, or each of eight comorbidities explored. Adjusting for prematurity or low birth weight exerted no effect on these results. In utero exposure to tobacco or alcohol does not assist in predicting clinical profiles of cerebral palsy.

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16. Acta Paediatr. 2012 Jul;101(7):e267-8. doi: 10.1111/j.1651-2227.2012.02688.x. Epub 2012 May 4.

Prediction for very preterm children: also for favourable neurodevelopmental outcome.

Charkaluk ML, Pierrat V.

Comment on: Prediction of outcome at 5 years from assessments at 2 years among extremely preterm children: a Norwegian national cohort study. [Acta Paediatr. 2012]

[PMID: 22554026](#) [PubMed - indexed for MEDLINE]

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